CLAIMS

What is claimed is:

1. A method for etching a stack with at least one silicon germanium layer over a substrate in a processing chamber, comprising providing a silicon germanium etch, comprising:

providing an etchant gas into the processing chamber, wherein the etchant gas comprises HBr, an inert diluent, and at least one of O_2 and N_2;

cooling the substrate to a temperature below 40° C; and

transforming the etching gas to a plasma to etch the silicon germanium layer.

2. The method, as recited in claim 1, wherein the stack further comprises a polysilicon layer over the silicon germanium layer, wherein at least one region of the polysilicon layer is doped, further comprising providing a break through etch of the polysilicon layer, comprising:

providing an etchant gas into the processing chamber, wherein the etchant gas comprises N_2, SF_6, and at least one of CHF_3 and CH_2F_2; and

transforming the etching gas to a plasma to etch the polysilicon layer.

3. The method, as recited in claim 2, further comprising providing a polysilicon main etch, comprising:

providing an etchant gas with at least one of Cl_2, HBr, CF_4, and O_2; and

transforming the etching gas to a plasma to etch the polysilicon layer.

4. The method, as recited in claim 3, wherein the etching the silicon germanium layer and the polysilicon layer provides a vertical profile.

5. The method, as recited in claim 4, wherein the stack further comprises a seed silicon layer under the silicon germanium layer, wherein the SiGe etch etches through the seed silicon layer.

6. The method, as recited in claim 5, wherein combined thicknesses of the seed silicon layer and silicon germanium layer is between 10 and 50 nanometers.

7. The method, as recited in claim 6, further comprising providing a photoresist mask over the stack.

8. The method, as recited in claim 7, wherein the photoresist mask is of a 193 or higher generation photoresist.

9. The method, as recited in claim 4, wherein the polysilicon layer has at least one undoped region.

10. The method, as recited in claim 1, wherein combined thicknesses of the seed silicon layer and silicon germanium layer is less than half a thickness of the polysilicon layer.

11. The method, as recited in claim 1, wherein the stack further comprises a seed silicon layer under the silicon germanium layer, wherein the SiGe etch etches through the seed silicon layer.

12. The method, as recited in claim 11, wherein combined thicknesses of the seed silicon layer and silicon germanium layer is between 10 and 50 nanometers.

13. The method, as recited in claim 1, further comprising providing a photoresist mask over the stack.

14. The method, as recited in claim 13, wherein the photoresist mask is of a 193 or higher generation photoresist.

15. A semiconductor device formed by the method of claim 1.

16. A method of etching a polysilicon layer over a substrate, wherein the polysilicon layer has at least one doped region, comprising:

placing the substrate in a processing chamber;

providing an etchant gas into the processing chamber, wherein the etchant gas

comprises N_2, SF_6, and at least one of CHF_3 and CH_2F_2; and

transforming the etching gas to a plasma to etch the polysilicon layer.

17. The method, as recited in claim 16, further comprising providing a polysilicon main etch, comprising:

providing an etchant gas with at least one of Cl_2, HBr, CF_4, and O_2; and

transforming the etching gas to a plasma to etch the polysilicon layer.

18. The method, as recited in claim 17, further comprising providing a photoresist mask over the stack.

19. The method, as recited in claim 18, wherein the photoresist mask is of a 193 or higher generation photoresist.

20. The method, as recited in claim 16, wherein the polysilicon layer has at least one undoped region.

21. A semiconductor device formed by the method of claim 16.

22. An apparatus for etching a stack with at least one silicon germanium layer over a substrate, comprising:

a processing chamber;

a gas source;

an energizing source;

a temperature control device, for controlling the temperature of the substrate;

a controller, wherein the controller comprises, computer readable media comprising:

computer readable code for providing an etchant gas from the gas source into the processing chamber, wherein the etchant gas comprises HBr, an inert diluent, and at least one of O_2 and N_2;

computer readable code for cooling the substrate to a temperature below 40° C; and

computer readable code for using the energizing source to transform the etching gas to a plasma to etch the silicon germanium layer.